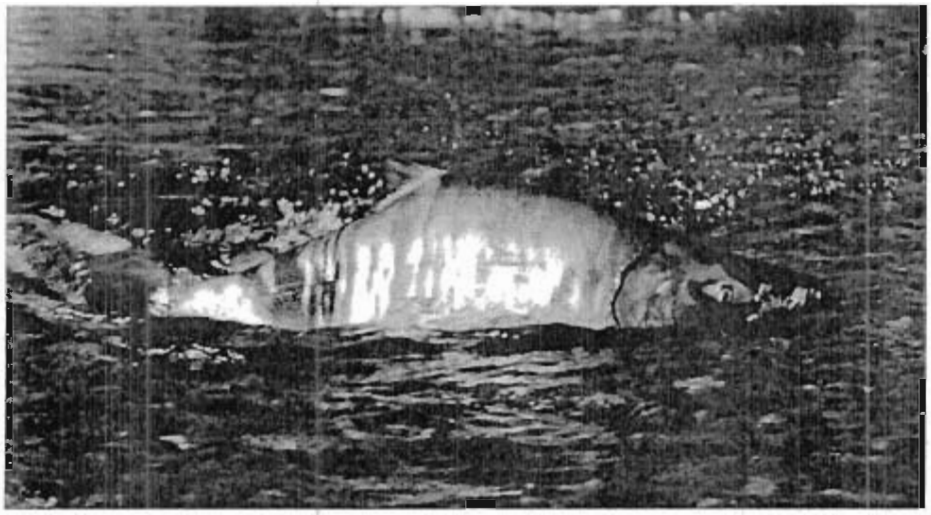
SALMONID ESCAPEMENTS INTO SELECTED NORTON SOUND DRAINAGES USING TOWERS AND WEIRS, 2002



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OEO/ADA STATEMENT

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ABSTRACT

The Alaska Department of Fish and Game (ADFG) operated counting tower projects on the Kwiniuk and Niukluk Rivers and a weir project on the Nome River during the 2002 season. Runs of chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, chinook salmon *O. tshawytscha*, sockeye salmon *O. nerka*, coho salmon *O.* kisutch, and Dolly Varden *Salvelinus malma* were enumerated. Objectives of the projects were to obtain daily and seasonal estimates of the timing and magnitude of the salmon escapement and to collect biological data (age, sex, and length) from sampled chum and coho salmon.

Expanded tower counts at Kwiniuk River were: 37,995 chum salmon, 1,114,410 pink salmon, 778 chinook salmon, 6,459 coho salmon, and -1,092 Dolly Varden (negative counts are down-river migrating fish). Expanded tower counts at Niukluk River were: 35,307 chum salmon, 645,141 pink salmon, 621 chinook salmon, 7,391 coho salmon, and 2,702 Dolly Varden. Total cumulative counts at the Nome River weir were: 1,720 chum salmon, 35,057 pink salmon, 7 chinook salmon, 3,418 coho salmon, 29 sockeye salmon, and 563 Dolly Varden during 2002.

Dominant age compositions during 2002 for the sampled chum salmon escapements by river were: Kwiniuk River 92% age-0.3 and 7% age-0.4, Niukluk River 76% age-0.3, 17% age-0.4, and 7% age-05, and Nome River 65% age-0.3, 30% age-0.4, and 5% age-0-5. Most of the coho salmon escapement samples were age class 2.1 representing 88% from Kwiniuk River, 94% from Niukluk River, and 81% from Nome River.

KEY WORDS: Norton Sound, Kotzebue Sound, harvest, escapement, *Oncorhynchus tshawytscha, O. nerka, O. keta, O. kisutch, O. gorbuscha*, age-sex-length composition.

INTRODUCTION

Norton Sound Salmon Management District includes all waters between the latitude of Point Romanof in the south and north to the latitude of Cape Douglas. This district includes six commercial salmon fishing subdistricts. All five species of pacific salmon (*Oncorhynchus*) return to natal rivers in Norton Sound and numerous anadromous streams are located within district boundaries (Figure 1). Current salmonid enumeration programs operated by the Alaska Department of Fish and Game (ADFG) in this district include two counting towers located on the Kwiniuk River, which drains into Subdistrict 3 (Moses Point), and Niukluk River, a tributary of the Fish River, which empties into Subdistrict 2 (Golovin), one weir project located on the Nome River, east of the city of Nome, in Subdistrict 1, and one test fish project on the Unalakleet River in Subdistrict 6. Additionally, five escapement counting projects are operated by cooperating agencies. Kawerak Inc. operates two weir projects in Subdistrict 1, on the Eldorado River and the Snake River, and a weir on the Pilgrim River in the Port Clarence District to the north. Unalakleet IRA council operates a tower project on the North River, a tributary of the Unalakleet River, which drains into subdistrict 6 (Unalakleet). U.S. Bureau of Land Management (BLM) operates a weir on a tributary of the Sinuk River, which empties into the northwestern portion of Norton Sound Subdistrict 1. Returns of chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, chinook salmon *O. tshawytscha*, sockeye salmon *O. nerka*, coho salmon *O. kisutch*, and Dolly Varden *Salvelinus malma* are enumerated at ADFG and cooperator projects. ADFG personnel also conduct numerous inseason aerial surveys on selected district rivers to monitor adult salmon escapements and assess run timing. Some aerial surveys are conducted on rivers with enumeration projects to ground truth and calibrate survey counts and to correlate data with historical data. This report summarizes 2002 data from ADFG enumeration projects.

Kwiniuk River drains into Norton Sound just east of the village of Moses Point, approximately 160 km east of Nome (Figure 1). Kwiniuk and Tubutulik Rivers are the primary salmon spawning tributaries in Subdistrict 3 (Moses Point). In 1962 commercial salmon fishing began in Subdistrict 3, primarily targeting chum, pink and coho salmon. No significant chum salmon commercial harvest has occurred since 1988 (Bue and Lean 1997). There were no commercial salmon harvested in this subdistrict in 2002. Subsistence fisheries occur in both drainages and in saltwater in the subdistrict. ADFG Subsistence Division reports harvest data gathered through village surveys. Since 1965, a salmon counting tower has operated on the Kwiniuk River enumerating chum, pink, and chinook salmon runs, but only recently has the tower operated through the coho salmon run (see Lean 1994, and Rob 1996a, 1996b, 1997a, 1998b, 1999c, Kohler 2000a, 2001a, and 2001b). Current location of the counting tower is shown in Figure 2.

Niukluk River is a major tributary of the Fish River drainage and enters the Fish River approximately 16 km above the village of White Mountain (Figures 1 and 2). Fish River empties into Golovnin Bay (Subdistrict 2) on the north coast of Norton Sound, and is the primary salmon spawning drainage in this subdistrict. Council village is located on the Niukluk River approximately 20 km above the confluence with Fish River. A road provides access from Nome to the Niukluk River at Council. Subsistence and sport fisheries occur on the Niukluk and Fish Rivers for all salmon species, Arctic grayling *Thymallus arcticus*, whitefish species *Prosopium* and *Coregonus*, and Dolly Varden. Subsistence Division reports harvests by residents of the communities of White Mountain and Golovin. Subsistence harvests by residents of Nome are

currently not monitored, but are thought to be increasing because of continued fishery restrictions and closures in Subdistrict 1. Commercial salmon fishing has been conducted sporadically in Subdistrict 2, and no commercial fisheries occurred during 2002.

Niukluk River counting tower has successfully operated since 1995 (Rob 1995b, 1997c, 1998c, 1999b and Kohler 2000b, 2001), and previously operated for approximately three weeks during 1979 (Schaefer 1979). Beginning in 2001, project duration was extended to encompass the coho salmon return. This project is operated to obtain accurate escapement information of inriver salmon stocks and Dolly Varden and as a means to calibrate the accuracy of aerial surveys to other tributaries in the Fish River drainage.

Nome River flows approximately 50 km south from Kigluaik Mountains and drains into Norton Sound approximately five km east of Nome (Figures 1 and 4). Commercial fishing has been progressively reduced through regulatory restrictions since the late 1970s and marine waters near the mouth have been closed since 1984. Sport and subsistence fishing in Nome River were closed in recent years because of low salmon returns (primarily chum salmon) and Arctic grayling population concerns. Subsistence and sport fisheries are currently managed similar to a commercial fishery; Emergency Orders regulate restrictions and fishing periods. A Tier I or Tier II subsistence permit/catch calendar is required when fishing in Nome River. Subsistence harvests are reported to ADFG Commercial Fishery Division by the returned catch calendars.

A salmon counting tower first operated on Nome River in 1993 (Bue 1994, Rob 1995a, and 1995b). Beginning in 1996, a weir replaced the counting tower and the camp/enumeration location was moved down river approximately 5 km to the current site. The 2002 season was the seventh year of weir operations (Rob 1997b, 1998a, 1999a, and Kohler 2000c, 2001c).

These ADFG enumeration projects, and cooperative projects, operate as a means to obtain timely and accurate escapement information and for the collection of biological data on salmon age, sex, and length (ASL) throughout the runs. Daily, the previous days count totals by species are relayed to the Nome ADFG office via single sideband (UHF) or marine (VHF) radio or satellite phone.

OBJECTIVES

1. Obtain daily and seasonal estimates of the timing and magnitude of salmon and Dolly Varden escapements to Kwiniuk, Niukluk, and Nome Rivers.

Sample chum and coho salmon runs; collect age, sex and length (ASL) information, for development of brood tables and for age, sex, and length frequencies to compare seasonal and yearly variations.

METHODS

Tower projects enumerate fish passage up and down river from a tower in timed periods. Usually, counts are conducted for a 20-minute period each hour and the counts are expanded to the whole hour; count times three equals one hour (20 min. x 3 = 60 min.). If all periods for 24 hours each day are counted, further expansion is not necessary and the expanded hourly total counts are summed to produce a daily total. Expansion methods used when count periods were missed are explained under each project. Negative count numbers signify down river passage. A tower or scaffold made of wood, aluminum or steel is placed on the bank next to the river (on both banks for wide rivers) where an observer sits on the elevated platform to count fish. Guy wires attached to the tower and staked to the ground or cabled to trees stabilize the tower during windy conditions. A flash panel (usually white plastic, vinyl, or canvas) was placed across the river bottom perpendicular to the river at the tower site and anchored in place with sand bags and stakes to keep fish from passing underneath. A flash panel provides a contrasting background to aid identification and count of passing fish. Partial (diversion) weirs are placed from the river bank(s) toward mid channel over the panel ends to force migrating fish out over the panel for easy observation. To count fish during darkness, lights are placed on the tower or suspended from a cable strung across the river above the flash panel. Either a 12-volt battery system or 120-volt generator system is used to provide power for lighting.

Weirs are built across the entire river and do not allow unmonitored fish passage. Aluminum weir stringers, top and bottom, span the river and are supported by metal or wood "A" frames or tripods. Metal conduit pickets are placed in the stringer holes and pounded into the bottom substrate effectively blocking fish passage. Picket spacing determined the size of fish to be passed and enumerated. Fish were enumerated through a weir by opening a gate or pulling weir pickets and counting the fish as they migrated through. Weirs installed on rivers with boat traffic have boat gates opened by the project crewmembers to allow for boat passage, or have floating sections boats can pass over; the weir section sinks when a boat passes and then re-floats after the boat departs. If fish passage occurred at night, lighting systems similar to tower projects were used to illuminate the weir area.

ASL samples at tower projects were collected from chum and coho salmon by seining inriver with a beach seine. Fish were normally collected from a live box for sampling at weir sites; the live box is installed and built into the upstream face of the weir. If insufficient numbers of fish entered the live box for sampling, fish were seined to meet goals. In 2002 the goal for each project site was three pulses of 160 fish for chum salmon and one 160 fish sample for coho salmon. Scales were taken for age determination, sex identified by visually examining external characteristics (such as: snout, vent, and body symmetry), and fork lengths measured on all sampled fish. Scales were removed from the left side of the fish in an area 2-3 scale rows above the lateral line crossed by a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Cleansed of slime, scales were mounted on gummed cards, and impressions later made in cellulose acetate cards with a scale press for age determination. Scale impressions were read with the aid of a microfiche reader and ages were reported in European notation where the first digit refers to the freshwater age and does not include the year spent in the gravel and the second digit refers to the ocean age (Koo 1962). Fish length was measured to the

nearest 0.5 cm from mid-eye to fork-of-tail (MEF). ASL samples for chum salmon were divided into three time segments (three samples of 160) to track changes in age and sex composition.

Kwiniuk River Tower

Kwiniuk River tower camp was located approximately 6 km upstream from the mouth of Kwiniuk River, on land leased to ADFG by Hans Jemewouk of Moses Point (Figure 2). The site was accessed by jet, motor-powered riverboat from the village of Moses Point, where crew personnel, supplies and equipment are taken by aircraft. Additional ADFG staff from Nome helped project crewmembers during installation and set-up. A 15 m vinyl flash panel was used at the site and covered approximately half the width of the river. One 6 m high aluminum scaffold tower was used for counting and the diversion weir extended from midstream (end of the flash panel) to the shore opposite the tower. A 12-volt lighting system illuminated the flash panel during dark counting periods.

Counting began on 17 June at 2000 hrs and continued until midnight on 11 September 2002. The three-person crew counted one twenty-minute period each hour for 24 hours, from midnight to midnight the following day. Daily counts presented in this report ran from midnight to midnight the following day. The only hours not counted this season were hours from 0600 to 1200 from 18 through 21 June. Expanded counts for missed times in this report were calculated as follows. On days of 18-hour period counts, hourly counts of the day before and the day following were added and the result was divided by two, giving expanded hourly counts for 18 hours. An expansion factor was calculated to compensate for the 6 hour periods not counted and was derived using data during the 24-hour count day, by dividing the total counts from 0600 to 1200 hours during the 24-hour count day by the total normal 18-hour count during the 24-hour count. This expansion factor was applied to data from three days before and after each 24-hour count by multiplying each day's 18-hour total by the 24-hour expansion factor, and adding that number to the 18-hour count for each day. This expansion was done for all enumerated species.

Niukluk River Tower

Niukluk River tower camp was located approximately 4 km upstream from the confluence of the Fish and Niukluk Rivers (Figure 2), just upstream of Tom Gray's camp, known locally as Mosquito Bar. A letter of understanding from the Council Native Corporation allowed ADFG to use their lands to conduct the tower operation. ADFG Habitat Division and the Alaska Department of Natural Resources, Division of Lands issued permits for the inriver diversion weir. Access to this site is via road to Council and by jet, motor-powered riverboat from Council to the tower. For 2002, the counting tower, partial weir, and flash panel were installed using the same methods as reported in detail in the 1995 Niukluk project report (Rob, 1995b). Additional ADFG staff provided assistance during project installation and set-up. A 120-volt lighting system was installed on the tower to illuminate the flash panel during dark periods.

Counting began at 1200 hours on 25 June, and through 1 July the three-person crew counted one 20 minute period each hour for 18 hours. Beginning 23 July until the end of the season, 10

September 2002, one 20 minute period was counted each hour for 24 hours, from midnight to midnight the following day. The only other hours not counted this season were for one hour each on 7, 8, 13, and 14 July, from 0000 to 1200 on 7 September. An average of previous and following day counts for the same time period was used. Expanded count methods for 18-hour period counts and daily totals are the same as Kwiniuk tower (above).

Nome River Weir

Nome River weir camp was located approximately 5 km upstream from the mouth of the river, on land leased to ADFG by the Sitnasuak Native Corporation (Figure 2). The project crew began installing the weir on 28 June, and the weir was operated through 11 September 2002. A gate in the weir was used during fish passage and enumeration. The weir was made of a series of 3.2 cm (1¼") pipes assembled in pairs using locking metal brackets. Aluminum stringers 5.6m (12') long connected the pairs of pipes horizontally. Metal conduit pipes of varying lengths, depending on water depth, were inserted vertically in holes drilled in the stringers on 4.5cm (1¾") centers. A gate in the weir was used during fish passage and enumeration. This weir was designed to be easily cleaned, fish tight and easily removed in the event of a flash flood.

RESULTS

Kwiniuk River expanded daily and cumulative total counts by species for 2002 are shown in Table 1. Expanded seasonal counts were: 37,995 chum salmon, 1,114,410 pink salmon, 778 chinook salmon, 6,459 coho salmon, and -1,092 Dolly Varden (downstream migrating). Expanded daily migration by year and species are shown in Appendix Table A.1. Actual recorded period expanded hourly counts were: 37,989 chum salmon, 1,114,422 pink salmon, 1,635 chinook salmon, and 6,459 coho salmon, and -1,092 Dolly Varden.

Niukluk tower expanded counts for 2002 were: 35,307 chum salmon, 645,141 pink salmon, 621 king salmon, 7,391 coho salmon, and 2,702 Dolly Varden (Table 2). Actual reported total hourly expanded counts were: 34,584 chum salmon, 636,893 pink salmon, 594 chinook salmon, 7,365 coho salmon, and 3,828 Dolly Varden. Historical escapements at the Niukluk River counting tower by species are shown in Appendix A.2.

Nome River weir total cumulative counts for 2002 were: 1,720 chum salmon, 35,057 pink salmon, 7 chinook salmon, 3,418 coho salmon, 29 sockeye salmon, and 563 Dolly Varden (Table 3). Historical escapements at the Nome River weir by species are shown in Appendix A.3.

Age and Sex Composition, and Length Frequency

Sampled chum salmon escapement age composition was predominantly age class 0.3 at the three rivers projects during 2002. Kwiniuk River was comprised of 92.1% age-0.3 and 6.6% age-0.4, and females comprised 56.8% of the sample (Table 4). Niukluk River was 76.0% age-0.3, 16.8% age-0.4, and 7.0% age-05, with 45.5% of the samples female (Table 5). Nome River was 64.5% age-

0.3, 29.5% age-0.4, and 5.2% age-05 (Table 6). Females comprised 53.6% of the run. Kwiniuk River chum salmon mean lengths (MEF) for the major age classes were all larger than at the other rivers. Age-0.3 mean lengths were 625 mm males and 607 mm for females, and age 0.4 fish were 636 mm males and 604 mm females. Niukluk age-0.3 were 587 mm for males and 561 mm for females, and age-0.4 were 608 mm males and 577 mm females. Nome age-0.3 males were 596 mm and females 555 mm, and age-0.4 males were 617 mm and female 581 mm. Chum salmon samples were stratified into three time periods (pulse samples) at all projects.

Coho salmon escapement samples from the Kwiniuk, Niukluk, and Nome Rivers were 88%, 94% and 81% and age-2.1 respectively (Table 7). Mean lengths by age group for all samples collected ranged from 503 mm for age-1.1 females in the Nome River escapement sample to 638 mm for age-3.1 males from the Nome and Niukluk River samples. Males comprised higher percentages of the samples at all three rivers: Kwiniuk R. 60.5%, Niukluk R. 56.6%, and Nome R. 51.8%.

DISCUSSION

Lower than average precipitation and river levels were encountered throughout the Norton Sound area during 2002 and helped make all projects successful. Flooding and turbidity associated with high water conditions are normally encountered in the fall reducing visibility for species determination, accuracy of enumeration, or missed days counting.

Kwiniuk River counting tower was the only escapement project operated in the Moses Point subdistrict during 2002. The chum salmon escapement was 37,995, which exceeded the current tower goal range of 15,600-31,200 and was 151% of the average tower count since 1965. Escapements were also above the even year average for pink salmon, and 2002 was the fourth highest year for chinook salmon since 1981 (Figure 3). Funds from the Norton Sound Initiative extended counting tower operations through the coho salmon run for a second year. The run was 6,459, 68% of the 2001 escapement of 9,532 coho salmon.

At Niukluk River counting tower, the 2002 returns (expanded counts) of chum and pink salmon were below average; the chum salmon count of 33,979 was 65% of the 1995-2001 average and the pink salmon count was only 58% of the even-year average. Chinook salmon escapement was the highest recorded since 1995 and coho salmon escapement was also above average (Figure 4).

At the Nome River weir in 2002, escapements were below average. Chum salmon count of 1,720 failed to meet the lower level of the escapement goal range of 2,900-4300. This goal has only been reached in one of the last five years. The pink salmon count of 35,057 was less than half the average and continues the downward trend in even-year escapements. Historical chinook salmon escapements into the Nome River are shown in Figure 5. Coho salmon escapement was above the 1993-2001 average, probably caused by later weir operation rather than increased abundance (Figure 5).

Age, Sex, and Length Composition

Although the chum ASL samples were divided into three strata, no effort was made to apportion escapement age structure by time period. As expected, the older chum tended to have a higher abundance during the earlier sampling periods. With the exception of Nome River where part of the samples were collected as they entered the system, we had no way of knowing if the fish sampled had just entered or had been present for a while before being seined. The age by system varied from a high of 92% age-0.3 in the Kwiniuk River to a low of 65% in the Nome River.

Age-2.1 predominated in the coho samples ranging from a high of 94% in the Niukluk River to a low of 81% in the Nome River.

LITERATURE CITED

Bue, F. and Lean, C. 1997. Norton Sound District Salmon Report to the Alaska Board of Fisheries. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A97-39, Anchorage.

Kohler. T. 2000a. Kwiniuk River Salmon Counting Tower Project Summary Report, 1999. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A00-08, Anchorage.

_____. 2000b. Niukluk River Salmon Counting Tower Project Summary Report 1999. Alaska Department of Fish and Game, Commercial Fisheries Division, Anchorage. Regional Information Report 3A00-09.

_____. 2000c. Nome River Salmon Counting Weir Project Summary Report, 1999. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A00-15 Anchorage.

_____. 2001a. Kwiniuk River Salmon Counting Tower Project, 2001. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A02-12, Anchorage.

_____. 2001b. Kwiniuk River Salmon Counting Tower Project Summary Report, 2000. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A01-17, Anchorage.

_____. 2001c. Nome River Salmon Counting Weir Project Summary Report, 2000. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A01-21 Anchorage.

Koo, T. S. Y. 1962. Age designation in salmon. Pages 41-47. Age and Growth Studies of Red

Salmon Scales by Graphical Means. Pages 54-57 *in* T. S. Y. Koo, editor. Studies of Alaska Red Salmon. University of Washington Press. Seattle.

Lean, C. 1994. Kwiniuk River Salmon Counting Tower Project, 1993. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A94-08, Anchorage.

Rob, P. J. 1994. Nome River Salmon Counting Tower Project Summary Report, 1993. Alaska Department of Fish & Game, Commercial Fisheries, Regional Information Report No. 3A94-26, Anchorage.

_____. 1995a. Nome River Salmon Counting Tower Project Summary Report, 1995. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A95-26, Anchorage.

_____. 1995b. Niukluk River Salmon Counting Tower Project Summary Report 1995. Alaska Department of Fish and Game, Commercial Fisheries Division, Anchorage. Regional Information Report 3A95-27.

_____. 1995c. Nome River Salmon Counting Tower Project Summary Report, 1994. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A95-35, Anchorage.

_____. 1996a. Kwiniuk River Salmon Counting Tower Project Summary Report, 1994. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A96-05, Anchorage.

_____. 1996b. Kwiniuk River Salmon Counting Tower Project Summary Report, 1995. Alaska Department of Fish & Game, Commercial Fisheries Division, AYK Region, Regional Information Report No. 3A96-08, Anchorage.

_____. 1997a. Kwiniuk River Salmon Counting Tower Project Summary Report, 1996. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A97-01, Anchorage.

_____. 1997b. Nome River Salmon Counting Weir Project Summary Report, 1996. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A97-03, Anchorage.

_____. 1997c. Niukluk River Salmon Counting Tower Project Summary Report 1996. Alaska Department of Fish and Game, Commercial Fisheries Division, Anchorage. Regional Information Report 3A97-04

_____. 1998a. Nome River Salmon Counting Weir Project Summary Report, 1997. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A98-02, Anchorage.

_____. 1998b. Kwiniuk River Salmon Counting Tower Project Summary Report, 1997. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A98-04, Anchorage.

_____. 1998c. Niukluk River Salmon Counting Tower Project Summary Report 1997. Alaska Department of Fish and Game, Commercial Fisheries Division, Anchorage. Regional Information Report 3A98-19.

_____. 1999a. Nome River Salmon Counting Weir Project Summary Report, 1998. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A99-06 Anchorage.

_____. 1999b. Niukluk River Salmon Counting Tower Project Summary Report 1998. Alaska Department of Fish and Game, Commercial Fisheries Division, Anchorage. Regional Information Report 3A99-10.

_____. 1999c. Kwiniuk River Salmon Counting Tower Project Summary Report, 1999. Alaska Department of Fish & Game, Commercial Fisheries Division, Regional Information Report No. 3A99-14, Anchorage.

Schaefer, G. 1979. Niukluk River Counting Tower Project. AYK Region, Norton Sound Escapement Report 21.

Table 1. Expanded daily and cumulative migrations of all salmonid species past the Kwiniuk River counting tower, Norton Sound, 2002.

Date	Daily chum salmon	Cumulative chum salmon	Daily pink salmon	Cumulative pink salmon	Daily chinook salmon	Cumulative chinook salmon	Daily coho salmon	Cumulative coho salmon	Daily Dolly Varden	Cumulative Dolly Varden
17-Jun	24	24	126	126	0	0	0	0	0	0
18-Jun	741	765	522	648	3	3	0	0	9	9
19-Jun	639	1,404	1,164	1,812	3	6	0	0	6	15
20-Jun	429	1,833	840	2,652	3	9	0	0	-9	6
21-Jun	531	2,364	1,404	4,056	6	15	0	0	6	12
22-Jun	939	3,303	5,631	9,687	0	15	0	0	15	27
23-Jun	1,026	4,329	5,672	15,360	3	18	0	0	6	33
24-Jun	339	4,668	-1,344	14,016	-3	15	0	0	0	33
25-Jun	1,482	6,150	3,438	17,454	6	21	0	0	0	33
26-Jun	663	6,813	2,889	20,343	15	36	0	0	0	33
27-Jun	2,988	9,801	25,275	45,618	18	54	0	0	0	33
28-Jun	1,644	11,445	29,133	74,751	135	189	0	0	87	120
29-Jun	1,821	13,266	35,379	110,130	83	272	0	0	45	165
30-Jun	231	13,497	5,718	115,848	18	290	0	0	9	174
1-Jul	534	14,031	20,709	136,557	42	332	0	0	6	174
17-Jun	477	14,508	24,684	161,241	15	347	0	0	6	180
3-Jul	747	15,255	-6,822	154,419	-4	343	0	0	0	180
4-Jul	1,413	16,668	23,850	178,269	39	382	0	0	0	180
5-Jul	1,647	18,315	66,423	244,692	39	421	0	0	6	186
6-Jul	2,811	21,126	133,425	378,117	84	505	0	0	0	186
7-Jul	1,587	22,713	65,139	443,256	51	556	0	0	0	186
8-Jul	2,286	24,999	69,687	512,943	60	616	0	0	0	186
9-Jul	447	25,446	36,153	549,096	9	625	0	0	0	186
10-Jul	2,298	27,744	138,348	687,444	27	652	6	6	3	189
11-Jul	2,571	30,315	111,759	799,203	42	694	0	6	6	195
12-Jul	468	30,783	58,224	857,427	9	703	0	6	0	195
13-Jul	498	31,281	37,767	895,194	6	709	0	6	0	195
14-Jul	963	32,244	59,013	954,207	6	715	0	6	3	201
15-Jul	351	32,595	50,445	1,004,652	6	721	0	6	0	201
16-Jul	852	33,447	41,910	1,046,562	9	730	0	6	0	201
17-Jul	507	33,954	23,352	1,069,914	15	745	0	6	0	201
18-Jul	585	34,539	13,737	1,083,651	0	745	0	6	0	201
19-Jul	669	35,208	9,204	1,092,855	9	754	0	6	0	201
20-Jul	573	35,781	2,181	1,095,036	18	772	0	6	0	201
21-Jul	345	36,126	2,811	1,097,847	-3	769	0	6	0	201
22-Jul	159	36,285	1,179	1,099,026	3	772	3	9	0	201
23-Jul	165	36,450	1,302	1,100,328	0	772	-3	6	0	201
24-Jul	258	36,708	1,212	1,101,540	0	772	12	18	0	201
25-Jul	219	36,927	2,805	1,104,345	3	775	12	30	0	201
26-Jul	33	36,960	900	1,105,245	0	775	3	33	0	201
27-Jul	204	37,164	1,404	1,106,649	0	775	-3	30	0	201
28-Jul	123	37,287	1,227	1,107,876	0	775	3	33	0	201
29-Jul	93	37,380	1,095	1,108,971	0	775	3	36	0	201
30-Jul	111	37,491	1,245	1,110,216	-3	772	9	45	0	201
31-Jul	99	37,590	732	1,110,948	12	784	12	57	0	201
1-Aug	87	37,677	615	1,111,563	3	787	36	93	51	252
2-Aug	93	37,770	477	1,112,040	-3	784	138	231	57	309
3-Aug	72	37,842	489	1,112,529	0	784	51	282	105	414
4-Aug	42	37,884	372	1,112,901	0	784	111	393	252	666
5-Aug	36	37,920	183	1,113,084	-3	781	273	666	114	780
6-Aug	6	37,926	141	1,113,225	0	781	78	744	84	864
7-Aug	0	37,926	219	1,113,444	0	781	69	813	81	945
8-Aug	0	37,926	207	1,113,651	0	781	33	846	84	1,029
9-Aug	0	37,926	177	1,113,828	-3	778	66	912	90	1,119
10-Aug	3	37,929	111	1,113,939	0	778	33	945	144	1,263
11-Aug	0	37,929	111	1,114,050	0	778	9	954	6	1,269
12-Aug	3	37,932	30	1,114,080	-3	775	147	1,101	3	1,272
13-Aug	0	37,932	96	1,114,176	3	778	48	1,149	9	1,281
14-Aug	6	37,938	54	1,114,230	0	778	27	1,176	9	1,290
15-Aug	6	37,944	36	1,114,266	0	778	99	1,275	3	1,293
16-Aug	3	37,947	39	1,114,305	0	778	228	1,503	18	1,311
17-Aug	3	37,950	9	1,114,314	0	778	69	1,572	6	1,317
18-Aug	3	37,953	15	1,114,329	0	778	624	2,196	45	1,362
19-Aug	3	37,956	9	1,114,338	0	778	291	2,487	9	1,371
20-Aug	0	37,956	0	1,114,338	0	778	60	2,547	-18	1,353
21-Aug	0	37,956	0	1,114,338	0	778	42	2,589	0	1,353
22-Aug	3	37,959	3	1,114,341	0	778	606	3,195	39	1,392
23-Aug	0	37,959	6	1,114,347	0	778	207	3,402	-81	1,311
24-Aug	3	37,962	0	1,114,347	0	778	213	3,615	3	1,314
25-Aug	0	37,962	9	1,114,356	0	778	21	3,636	0	1,314
26-Aug	3	37,965	0	1,114,356	0	778	36	3,672	0	1,314
27-Aug	3	37,968	9	1,114,365	0	778	69	3,741	3	1,317
28-Aug	0	37,968	0	1,114,365	0	778	51	3,792	12	1,329
29-Aug	0	37,968	0	1,114,365	0	778	156	3,948	0	1,329
30-Aug	6	37,974	3	1,114,368	0	778	513	4,461	6	1,335
31-Aug	0	37,974	3	1,114,371	0	778	63	4,524	9	1,335
1-Sep	0	37,974	9	1,114,380	0	778	138	4,662	120	1,455
2-Sep	3	37,977	3	1,114,383	0	778	150	4,812	36	1,491
3-Sep	0	37,977	6	1,114,389	0	778	483	5,295	0	1,491
4-Sep	9	37,986	12	1,114,401	0	778	558	5,853	0	1,491
5-Sep	3	37,992	9	1,114,410	0	778	219	6,072	3	1,494
6-Sep	0	37,992	3	1,114,413	0	778	285	6,357	-549	945
7-Sep	0	37,992	-6	1,114,407	0	778	60	6,417	-1545	-600
8-Sep	0	37,992	0	1,114,407	0	778	0	6,417	-492	-1,092
9-Sep	3	37,995	0	1,114,407	0	778	6	6,423	0	-1,092
10-Sep	0	37,995	3	1,114,410	0	778	15	6,438	0	-1,092
11-Sep	-0	37,995	0	1,114,410	0	778	21	6,459	0	-1,092
		37,995		1,114,410		778		6,459		-1,092

Table 2. Expanded daily and cumulative migrations of all salmonid species past the Niukluk River counting tower, Norton Sound, 2002.

Date	Daily chum salmon	Cumulative chum salmon	Daily pink salmon	Cumulative pink salmon	Daily chinook salmon	Cumulative chinook salmon	Daily coho salmon	Cumulative coho salmon	Daily Dolly Varden	Cumulative Dolly Varden
25-Jun	45	45	-3	-3	0	0	0	0	-3	-3
26-Jun	239	284	333	330	0	0	0	0	0	-3
27-Jun	1,777	2,061	3,762	4,092	18	18	0	0	156	153
28-Jun	352	2,413	4,557	8,649	71	89	0	0	34	187
29-Jun	501	2,914	3,750	12,399	18	107	0	0	76	263
30-Jun	249	3,163	1,638	14,037	25	132	0	0	62	325
1-Jul	2,022	5,185	14,286	28,323	4	136	0	0	90	415
2-Jul	726	5,911	10,155	38,478	132	268	0	0	45	460
3-Jul	192	6,103	9,852	48,330	39	307	0	0	87	547
4-Jul	624	6,727	18,908	67,238	90	397	0	0	84	631
5-Jul	585	7,312	10,641	77,879	0	397	0	0	69	700
6-Jul	1,185	8,497	31,272	109,151	60	457	0	0	42	742
7-Jul	1,124	9,621	34,166	143,317	24	481	0	0	30	772
8-Jul	1,258	10,879	35,286	178,603	8	489	0	0	6	778
9-Jul	1,731	12,610	43,980	222,583	30	519	0	0	54	832
17-Jan	1,899	14,509	54,168	276,751	18	537	0	0	54	886
11-Jul	1,131	15,640	33,711	310,462	9	546	0	0	33	919
12-Jul	678	16,318	18,840	329,302	0	546	0	0	6	925
13-Jul	954	17,272	25,373	354,675	21	567	0	0	0	925
14-Jul	1,772	19,044	42,615	397,290	6	573	6	6	3	928
15-Jul	1,104	20,148	26,442	423,732	9	582	0	6	6	934
16-Jul	1,047	21,195	26,331	450,063	0	582	6	12	0	934
17-Jul	2,352	23,547	55,923	505,986	6	588	3	15	3	937
18-Jul	1,335	24,882	43,002	548,988	6	594	3	18	0	937
19-Jul	1,584	26,466	39,621	588,609	0	594	9	27	6	943
20-Jul	1,077	27,543	23,679	612,288	3	597	0	27	0	943
21-Jul	636	28,179	13,899	626,187	0	597	0	27	0	943
22-Jul	540	28,719	5,034	631,221	6	603	3	30	9	952
23-Jul	516	29,235	2,241	633,462	0	603	6	36	6	958
24-Jul	957	30,192	2,775	636,237	6	609	0	36	9	967
25-Jul	600	30,792	2,115	638,352	0	609	6	42	0	967
26-Jul	309	31,101	879	639,231	0	609	0	42	12	979
27-Jul	531	31,632	744	639,975	0	609	0	42	3	982
28-Jul	354	31,986	825	640,800	-3	606	0	42	9	991
29-Jul	309	32,295	423	641,223	3	609	0	42	21	1,012
30-Jul	399	32,694	567	641,790	12	621	0	42	27	1,039
31-Jul	333	33,027	447	642,237	0	621	15	57	12	1,051
1-Aug	360	33,387	600	642,837	3	624	117	174	27	1,078
2-Aug	318	33,705	525	643,362	0	624	15	189	90	1,168
3-Aug	141	33,846	309	643,671	0	624	30	219	69	1,237
4-Aug	186	34,032	198	643,869	0	624	54	273	159	1,396
5-Aug	192	34,224	327	644,196	0	624	12	285	93	1,489
6-Aug	165	34,389	231	644,427	3	627	9	294	63	1,552
7-Aug	249	34,638	159	644,586	-3	624	69	363	51	1,603
8-Aug	90	34,728	66	644,652	3	627	45	408	33	1,636
9-Aug	114	34,842	42	644,694	-3	624	45	453	63	1,699
10-Aug	102	34,944	117	644,811	3	627	108	561	9	1,708
11-Aug	66	35,010	54	644,865	-6	621	171	732	60	1,768
12-Aug	90	35,100	63	644,928	0	621	27	759	36	1,804
13-Aug	51	35,151	69	644,997	0	621	204	963	45	1,849
14-Aug	9	35,160	-15	644,982	0	621	36	999	39	1,888
15-Aug	48	35,208	36	645,018	0	621	231	1,230	42	1,930
16-Aug	18	35,226	12	645,030	0	621	528	1,758	51	1,981
17-Aug	33	35,259	12	645,042	0	621	279	2,037	27	2,008
18-Aug	0	35,259	9	645,051	0	621	402	2,439	18	2,026
19-Aug	6	35,265	6	645,057	0	621	153	2,592	24	2,050
20-Aug	-3	35,262	6	645,063	0	621	177	2,769	39	2,089
21-Aug	3	35,265	39	645,102	0	621	474	3,243	21	2,110
22-Aug	-6	35,259	15	645,117	0	621	213	3,456	54	2,164
23-Aug	0	35,259	-3	645,114	0	621	135	3,591	99	2,263
24-Aug	27	35,286	6	645,120	0	621	327	3,918	24	2,287
25-Aug	6	35,292	3	645,123	0	621	192	4,110	30	2,317
26-Aug	0	35,292	0	645,123	0	621	48	4,149	27	2,344
27-Aug	-3	35,289	0	645,123	0	621	339	4,488	42	2,386
28-Aug	9	35,298	0	645,123	0	621	657	5,145	39	2,425
29-Aug	0	35,298	3	645,126	0	621	480	5,625	42	2,467
30-Aug	9	35,307	-3	645,123	0	621	288	5,913	24	2,491
31-Aug	0	35,307	3	645,126	0	621	288	6,201	57	2,548
1-Sep	0	35,307	0	645,126	0	621	429	6,630	78	2,626
2-Sep	0	35,307	0	645,126	0	621	219	6,849	27	2,653
3-Sep	-3	35,304	3	645,129	0	621	168	7,017	27	2,680
4-Sep	-3	35,301	0	645,129	0	621	183	7,200	24	2,704
5-Sep	0	35,301	3	645,132	0	621	27	7,227	12	2,716
6-Sep	3	35,304	3	645,135	0	621	-3	7,224	-6	2,710
7-Sep	0	35,304	3	645,138	0	621	104	7,328	-2	2,708
8-Sep	0	35,304	3	645,141	0	621	78	7,406	0	2,708
9-Sep	0	35,304	0	645,141	0	621	-12	7,394	9	2,717
10-Sep	3	35,307	0	645,141	0	621	-3	7,391	-15	2,702
		35,307		645,141		621		7,391		2,702

Table 3. Daily and cumulative passage of all salmonid species at the Nome River weir, Norton Sound, 2002.

Date	Daily chum salmon	Cumulative chum salmon	Daily pink salmon	Cumulative pink salmon	Daily chinook salmon	Cumulative chinook salmon	Daily coho salmon	Cumulative coho salmon	Daily Dolly Varden	Cumulative Dolly Varden	Daily Sockeye salmon	Cumulative Sockeye salmon
29-Jun	0	0	0	0	0	0	0	0	0	0	0	0
30-Jun	1	1	0	0	0	0	0	0	1	1	0	0
1-Jul	1	2	2	2	0	0	0	0	0	1	0	0
2-Jul	1	3	7	9	0	0	0	0	0	1	0	0
3-Jul	3	6	7	16	0	0	0	0	1	2	0	0
4-Jul	8	14	14	30	0	0	0	0	2	4	0	0
5-Jul	14	28	33	63	0	0	0	0	2	6	0	0
6-Jul	20	48	21	84	0	0	0	0	6	12	0	0
7-Jul	33	81	83	167	0	0	0	0	0	12	0	0
8-Jul	166	247	486	653	0	0	0	0	0	12	0	0
9-Jul	102	349	598	1,251	0	0	0	0	2	14	0	0
10-Jul	19	368	321	1,572	1	1	0	0	5	19	0	0
11-Jul	65	433	862	2,434	0	1	2	2	3	22	1	1
12-Jul	14	447	854	3,288	0	1	0	2	12	34	0	1
13-Jul	60	507	1,294	4,582	0	1	5	7	4	38	0	1
17-Jan	189	696	4,085	8,667	1	2	0	7	3	41	1	2
15-Jul	51	747	1,912	10,579	0	2	1	8	3	44	0	2
16-Jul	29	776	1,656	12,235	1	3	0	8	1	45	0	2
17-Jul	115	891	7,383	19,618	0	3	0	8	7	52	0	2
18-Jul	71	962	3,794	23,412	0	3	2	10	7	59	0	2
19-Jul	146	1,108	5,475	28,887	1	4	0	10	4	63	0	2
20-Jul	15	1,123	708	29,595	1	5	0	10	0	63	0	2
21-Jul	0	1,123	60	29,655	0	5	0	10	1	64	0	2
22-Jul	3	1,126	55	29,710	0	5	0	10	0	64	0	2
23-Jul	12	1,138	20	29,730	0	5	0	10	4	68	0	2
24-Jul	34	1,172	109	29,839	0	5	0	10	2	70	1	3
25-Jul	82	1,254	1,092	30,931	0	5	0	10	12	82	1	4
26-Jul	7	1,261	282	31,213	0	5	1	11	7	89	0	4
27-Jul	9	1,270	458	31,671	0	5	0	11	11	100	0	4
28-Jul	9	1,279	264	31,935	0	5	1	12	11	111	0	4
29-Jul	9	1,288	309	32,244	0	5	0	12	6	117	0	4
30-Jul	13	1,301	218	32,462	0	5	0	12	4	121	1	5
31-Jul	20	1,321	432	32,894	0	5	1	13	11	132	2	7
1-Aug	19	1,340	389	33,283	0	5	0	13	12	144	1	8
2-Aug	11	1,351	287	33,570	0	5	2	15	16	160	3	11
3-Aug	9	1,360	155	33,725	0	5	0	15	10	170	2	13
4-Aug	46	1,406	192	33,917	0	5	1	16	10	180	2	15
5-Aug	37	1,443	300	34,217	0	5	2	18	17	197	0	15
6-Aug	2	1,445	17	34,234	0	5	0	18	3	200	0	15
7-Aug	8	1,453	54	34,288	0	5	0	18	2	202	0	15
8-Aug	15	1,468	50	34,338	0	5	0	18	2	204	0	15
9-Aug	16	1,484	59	34,397	1	6	0	18	8	212	0	15
10-Aug	17	1,501	54	34,451	0	6	0	18	4	216	0	15
11-Aug	12	1,513	50	34,501	0	6	2	20	15	231	0	15
12-Aug	12	1,525	13	34,514	0	6	0	20	1	232	0	15
13-Aug	14	1,539	29	34,543	0	6	0	20	3	235	0	15
14-Aug	6	1,545	12	34,555	0	6	1	21	4	239	0	15
15-Aug	12	1,557	18	34,573	0	6	0	21	5	244	0	15
16-Aug	7	1,564	5	34,578	0	6	0	21	2	246	0	15
17-Aug	14	1,578	14	34,592	0	6	0	21	17	263	1	16
18-Aug	15	1,593	10	34,602	0	6	3	24	6	269	0	16
19-Aug	13	1,606	21	34,623	0	6	9	33	4	273	0	16
20-Aug	12	1,618	40	34,663	0	6	88	121	31	304	0	16
21-Aug	6	1,624	24	34,687	0	6	48	169	15	319	1	17
22-Aug	15	1,639	54	34,741	0	6	239	408	49	368	3	20
23-Aug	3	1,642	17	34,758	0	6	154	562	12	380	0	20
24-Aug	2	1,644	10	34,768	0	6	55	617	13	393	1	21
25-Aug	5	1,649	5	34,773	1	7	3	620	0	393	0	21
26-Aug	6	1,655	7	34,780	0	7	176	796	4	397	1	22
27-Aug	11	1,666	16	34,796	0	7	554	1,350	11	408	3	25
28-Aug	1	1,667	11	34,807	0	7	211	1,561	1	409	0	25
29-Aug	3	1,670	5	34,812	0	7	140	1,701	7	416	0	25
30-Aug	4	1,674	9	34,821	0	7	88	1,789	5	421	0	25
31-Aug	5	1,679	10	34,831	0	7	55	1,844	4	425	0	25
1-Sep	9	1,688	19	34,850	0	7	227	2,071	21	446	0	25
2-Sep	0	1,688	4	34,854	0	7	35	2,106	1	447	0	25
3-Sep	0	1,688	2	34,856	0	7	0	2,106	1	448	0	25
4-Sep	9	1,697	76	34,932	0	7	925	3,031	81	529	4	29
5-Sep	11	1,708	52	34,984	0	7	119	3,150	12	541	0	29
6-Sep	8	1,716	49	35,033	0	7	219	3,369	7	548	0	29
7-Sep	0	1,716	13	35,046	0	7	37	3,406	5	553	0	29
8-Sep	0	1,716	0	35,046	0	7	0	3,406	0	553	0	29
9-Sep	1	1,717	4	35,050	0	7	0	3,406	3	556	0	29
10-Sep	1	1,718	1	35,051	0	7	1	3,407	1	557	0	29
11-Sep	2	1,720	6	35,057	0	7	11	3,418	6	563	0	29
		1,720		35,057		7		3,418		563		29

Table 4. Chum salmon age and sex composition, and mean length by sampling period and total, Kwiniuk River, Norton Sound, 2002.

		Brood Year and (Age Group)[1]				
		1999 (0.2)	1998 (0.3)	1997 (0.4)	1996 (0.5)	Total
Stratum Dates:						
Sampling Dates:	6/19-6/30					
Sample Size:	162					
Male	Percent of Sample	0.0%	50.0%	6.2%	0.0%	56.2%
	Number in sample	0	81	10	0	91
	Mean Length (mm)[2]		628	639	623	
Female	Percent of Sample	0.0%	40.1%	3.1%	0.6%	43.8%
	Number in sample	0	65	5	1	71
	Mean Length (mm)[2]		589	595	640	
Total	Percent of Sample	0.0%	90.1%	9.3%	0.6%	100.0%
	Number in sample	0	146	15	1	162
17						
Stratum Dates:						
Sampling Dates:	7/1-7/11					
Sample Size:	183					
Male	Percent of Sample	0.0%	36.6%	5.5%	0.5%	42.6%
	Number in sample	0	67	10	1	78
	Mean Length (mm)[2]		627	646	615	
Female	Percent of Sample	0.5%	53.0%	2.7%	1.1%	57.4%
	Number in sample	1	97	5	2	105
	Mean Length (mm)[2]	575	590	617	608	
Total	Percent of Sample	0.5%	89.6%	8.2%	1.6%	100.0%
	Number in sample	1	164	15	3	183
Stratum Dates:						
Sampling Dates:	7/13-7/21					
Sample Size:	139					
Male	Percent of Sample	0.0%	27.3%	0.7%	0.7%	28.8%
	Number in sample	0	38	1	1	40
	Mean Length (mm)[2]		579	587	608	
Female	Percent of Sample	0.0%	70.5%	0.7%	0.0%	71.2%
	Number in sample	0	98	1	0	99
	Mean Length (mm)[2]		554	567	560	
Total	Percent of Sample	0.0%	97.8%	1.4%	0.7%	100.0%
	Number in sample	0	136	2	1	139
Stratum Dates:						
Sampling Dates:	6/19-7/21			Season Total		
Sample Size:	484					
Male	Percent of Sample	0.0%	38.4%	4.3%	0.4%	43.2%
	Number in sample	0	186	21	2	209
	Mean Length (mm)[2]		625	636	600	
Female	Percent of Sample	0.2%	53.7%	2.3%	0.6%	56.8%
	Number in sample	1	260	11	3	275
	Mean Length (mm)[2]	575	607	604	618	
Total[3]	Percent of Sample	0.2%	92.1%	6.6%	1.0%	100.0%
	Number in sample	1	446	32	5	484

[1] The number of fish in each stratum age and sex category are derived from the sample percentages.

[2] Length was measured from mid-eye to fork-of-tail (MEF).

[3] The number of fish in total are the stratum sums; total percentages are derived from the sums.

Table 5. Chum salmon age and sex composition, and mean length by sampling period and total, Niukluk River, Norton Sound, 2002.

		Brood Year and (Age Group)[1]				
		1999 (0.2)	1998 (0.3)	1997 (0.4)	1996 (0.5)	Total
Stratum Dates:						
Sampling Date	7/3-7/9					
Sample Size:	166					
Male	Percent of Sample	0.0%	42.8%	12.7%	8.4%	63.9%
	Number in sample	0	71	21	14	106
	Mean Length (mm)[2]		594	607	623	
Female	Percent of Sample	0.0%	24.1%	8.4%	3.6%	36.1%
	Number in sample	0	40	14	6	60
	Mean Length (mm)[2]		568	587	596	
Total	Percent of Sample	0.0%	66.9%	21.1%	12.0%	100.0%
	Number in sample	0	111	35	20	166
17						
Stratum Dates:						
Sampling Date	7/13-7/17					
Sample Size:	149					
Male	Percent of Sample	0.0%	40.3%	9.4%	1.3%	51.0%
	Number in Escapement	0	60	14	2	76
	Mean Length (mm)[2]		585	620	639	
Female	Percent of Sample	0.7%	39.6%	6.7%	2.0%	49.0%
	Number in Escapement	1	59	10	3	73
	Mean Length (mm)[2]	557	562	572	578	
Total	Percent of Sample	0.7%	79.9%	16.1%	3.4%	100.0%
	Number in sample	1	119	24	5	149
Stratum Dates:						
Sampling Date	7/23-7/26					
Sample Size:	131					
Male	Percent of Sample	0.0%	38.9%	4.6%	3.1%	46.6%
	Number in sample	0	51	6	4	61
	Mean Length (mm)[2]		579	587	608	
Female	Percent of Sample	0.0%	44.3%	7.6%	1.5%	53.4%
	Number in sample	0	58	10	2	70
	Mean Length (mm)[2]		554	567	560	
Total	Percent of Sample	0.0%	83.2%	12.2%	4.6%	100.0%
	Number in sample	0	109	16	6	131
Stratum Dates:						
Sampling Date	7/4-7/26			Season Total		
Sample Size:	446					
Male	Percent of Sample	0.0%	40.8%	9.2%	4.5%	54.5%
	Number in sample	0	182	41	20	243
	Mean Length (mm)[2]		587	608	621	
Female	Percent of Sample	0.2%	35.2%	7.6%	2.5%	45.5%
	Number in sample	1	157	34	11	203
	Mean Length (mm)[2]	557	561	577	585	
Total[3]	Percent of Sample	0.2%	76.0%	16.8%	7.0%	100.0%
	Number in sample	1	339	75	31	446

[1] The number of fish in each stratum age and sex category are derived from the sample percentages.

[2] Length was measured from mid-eye to fork-of-tail (MEF).

[3] The number of fish in total are the stratum sums; total percentages are derived from the sums.

Table 6. Chum salmon age and sex composition, and mean length by sampling period and total, Nome River, Norton Sound, 2002.

		Brood Year and (Age Group)				
		1999 (0.2)	1998 (0.3)	1997 (0.4)	1996 (0.5)	Total
Sampling Dates:	7/4-7/15					
Sample Size:	145					
Male	Percent of Sample	0.0%	26.2%	13.1%	2.8%	42.1%
	Number in Sample	0	44	31	9	84
	Mean Length (mm)[1]		571	588	617	
Female	Percent of Sample	0.0%	30.3%	21.4%	6.2%	57.9%
	Number in Sample	0	38	19	4	61
	Mean Length (mm)[1]		605	621	622	
Total	Percent of Sample	0.0%	56.6%	34.5%	9.0%	100.0%
	Number in Sample	0	82	50	13	145
17	7/16-7/27					
Sample Size:	143					
Male	Percent of Sample	0.0%	25.2%	12.6%	0.7%	38.5%
	Number in Sample	0	36	18	1	55
	Mean Length (mm)[1]		580	613	653	
Female	Percent of Sample	0.7%	42.7%	16.8%	1.4%	61.5%
	Number in Sample	1	61	24	2	88
	Mean Length (mm)[1]	542	552	583	558	
Total	Percent of Sample	0.7%	67.8%	29.4%	2.1%	100.0%
	Number in Sample	1	97	42	3	143
Sampling Dates:	8/4-8/22					
Sample Size:	152					
Male	Percent of Sample	0.7%	27.6%	13.2%	1.3%	42.8%
	Number in Sample	1	42	20	2	65
	Mean Length (mm)[1]	568	601	616	636	
Female	Percent of Sample	0.7%	41.4%	11.8%	3.3%	57.2%
	Number in Sample	1	63	18	5	87
	Mean Length (mm)[1]	539	576	600	576	
Total	Percent of Sample	1.3%	69.1%	25.0%	4.6%	100.0%
	Number in Sample	2	105	38	7	152
Sampling Dates:	7/4-8/22	Season Total				
Sample Size:	440					
Male	Percent of Sample	0.2%	27.7%	15.7%	2.7%	46.4%
	Number in Sample	1	122	69	12	204
	Mean Length (mm)[1]	568	596	617	627	
Female	Percent of Sample	0.5%	36.8%	13.9%	2.5%	53.6%
	Number in Sample	2	162	61	11	236
	Mean Length (mm)[1]	527	555	581	579	
Total[2]	Percent of Sample	0.7%	64.5%	29.5%	5.2%	100.0%
	Number in Sample	3	284	130	23	440

[1] Length was measured from mid-eye to fork-of-tail (MEF).

[2] The number of fish in total are the sample sums; total percentages are derived from the sums.

Table 7. Norton Sound District coho salmon escapement sample age and sex composition, and mean length, 2002.

			Brood Year and (Age Group)				
			1999 (1.1)	1998 (2.1)	1997 (3.1)	1996 (4.1)	Total
Kwiniuk River							
Sampling Dates:	8/3-8/23						
Sample Size:		157					
Male	Percent of Sample		3.82%	52.87%	3.82%		60.51%
	Number		6	83	6		95
	Mean length (mm)[1]		543	601	596		
Female	Percent of Sample		3.82%	35.03%	0.64%		39.49%
	Number		6	55	1		62
	Mean length (mm)[1]		578	603	625		
17 Total	Percent of Sample		7.6%	87.9%	4.5%		100.0%
	Number		12	138	7		157
Niukluk River							
Sampling Dates:	8/13-9/8						
Sample Size:		143					
Male	Percent of Sample		0.00%	54.55%	2.10%		56.64%
	Number		0	78	3		81
	Mean length (mm)[1]			596	638		
Female	Percent of Sample		0.70%	39.16%	3.50%		43.36%
	Number		1	56	5		62
	Mean length (mm)[1]		527	594	611		
Total	Percent of Sample		0.7%	93.7%	5.6%		100.0%
	Number		1	134	8		143
Nome River							
Sampling Dates:	8/11-8/28						
Sample Size:		139					
Male	Percent of Sample		0.00%	40.29%	10.07%	0.72%	51.08%
	Number		0	56	14	1	71
	Mean length (mm)[1]			581	617	638	
Female	Percent of Sample		1.44%	40.29%	7.19%		48.92%
	Number		2	56	10		68
	Mean length (mm)[1]		503	571	585		
Total	Percent of Sample		1.4%	80.6%	17.3%	0.7%	100.0%
	Number		2	112	24	1	139

[1] Length was measured from mid-eye to fork-of-tail (fork length).

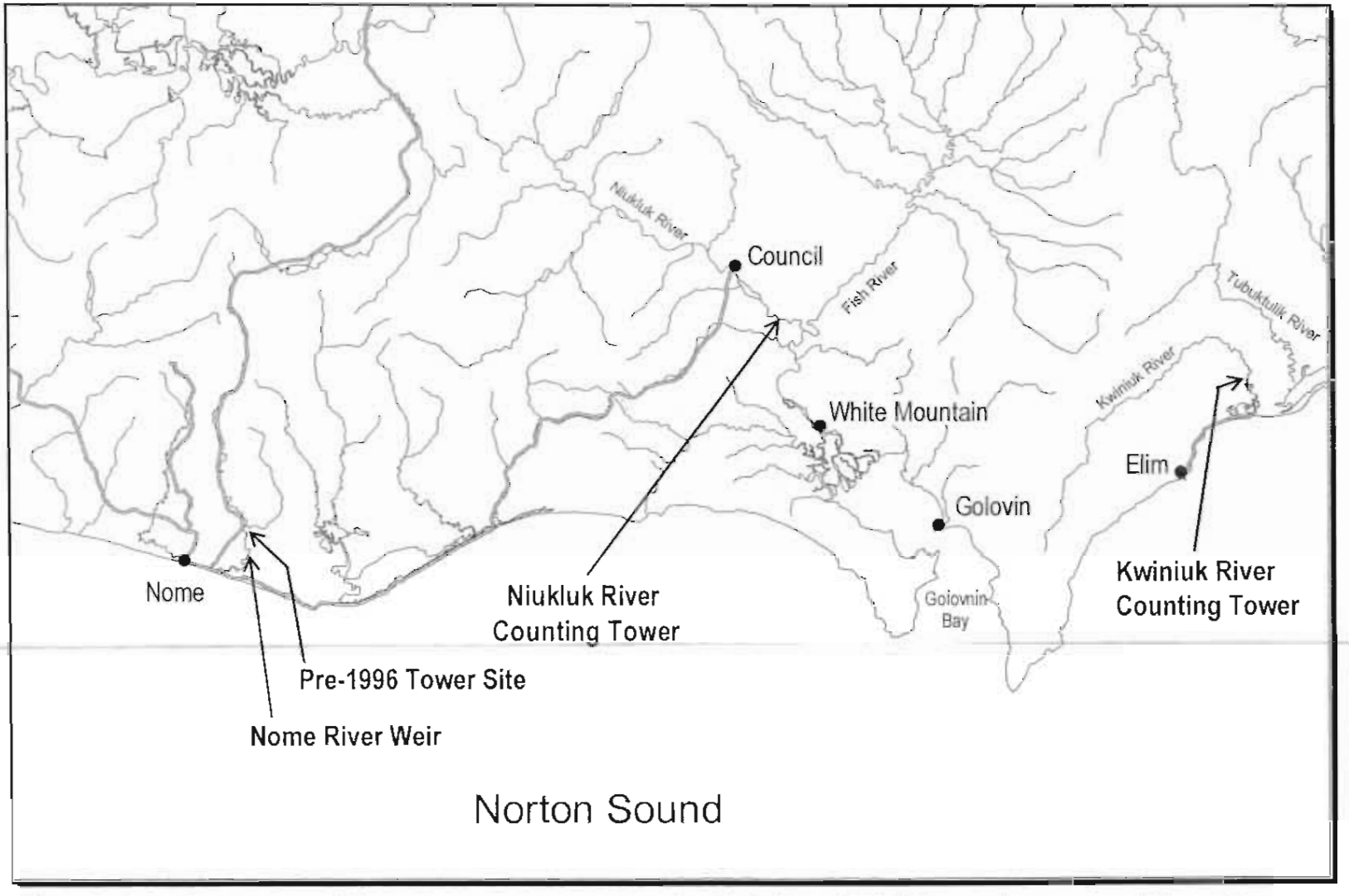

Figure 2. Area location map of Department escapment project sites; Kwiniuk and Niukluk counting towers and Nome River weir and previous tower site, Norton Sound, Alaska.

Appendix A.1. Historical salmon escapements at the Kwiniuk River counting tower, 1965-2002.[1]

Year	Operating period	Chum	Pink	Chinook	Coho
1965	June 18-Jul 19	32,861	8,668	19	
1966	June 19-Jul 28	32,786	10,629	7	
1967	June 18-Jul 28	26,661	3,587	13	
1968	June 18-Jul 24	19,976	129,052	27	
1969	June 26-Jul 26	19,687	56,683	12	
1970	June 25-Jul 29	66,604	226,831		
1971	June 29-Jul 29	38,679	16,634		
1972	June 28-Jul 27	30,686	62,461	65	
1973	June 25-Jul 25	28,029	37,070	57	
1974	June 20-Jul 26	35,161	39,375	62	
1975	July 4-Jul 26	14,049	55,293	44	
1976	July 4-Jul 25	8,508	35,226	12	
1977	June 26-Jul 25	21,798	47,934		
17	July 4-Jul 22	11,049	70,148		
18	June 28-Jul 25	12,355	167,492	107	
19	June 22-Jul 28	19,374	319,363	177	
20	June 19-Aug 2	34,561	566,417	136	
21	June 21-Jul 26	44,036	469,674	138	
22	June 19-Jul 27	56,927	251,965	267	
23	June 19-Jul 25	54,043	736,544	736 [2]	
24	June 26-Jul 28	9,013	18,237	955 [3]	
25	June 19-Jul 26	24,704	241,446	653	
26	June 25-Jul 23	16,134	5,567	314	
27	June18-Jul 26	13,302	187,991	321	
28	June 27-Jul 27	14,282	27,487	248	
29	June 21-Jul 25	13,957	416,511	900	
30	June 18-Jul 27	19,800	53,499	709	
31	June 27-Jul 28	12,077	1,464,717	479	
32	June 27-Jul 27	15,823	43,065	594	
33	June 23-Aug 9	32,875	2,304,099	625	2,547
1995	June 21-Jul 26	42,703	17,509	485	114
1996	June 20-Jul 25	28,493	907,894	577	461
1997	June 18-Jul 27	20,118	9,536	972	0
1998	June 18-Jul 27	24,248	655,933	302	0
1999	June 25-Jul 28	8,763	608	115	0
2000	June 22-Jul 27	12,878	750,173	144	41
2001	June 27-Sept 15	16,598	8,423	258	9,532
2002	June 17-Sept 11	37,995	1,114,410	778	6,459
	Average	25,232	281,723	319	2,128

[1] Counts from 1965-1994 taken from the original project reports located in the Nome office of Fish and Game, counts for 1995-2001 are from Kohler 2002.

[2] Chinook salmon counts from 1965-1984 not expanded.

[3] Chinook salmon counts after 1985 were expanded.

lmon passage at the Kwiniuk River counting tower, Norton Sound, 1965-2002.

Appendix A.2. Historical salmon escapements at the Niukluk River counting tower, 1995-2002.

Year	Operating period	Chum	Pink	Chinook	Coho
1995	June 29-Sept 12	86,333	17,089	123	4,173
1996	June 23-Sept 12	80,121	1,154,881	237	12,781
1997	June 28-Sept 9	57,304	10,466	259	3,994
1998	July 4-August 9	45,587	1,624,436	258	839
1999	June 4-Sept 4	35,240	20,355	40	4,260
2000	July 4-Aug-27	29,572	961,603	48	11,382
2001	July 10-Sept 8	30,662	41,625	30	3,468
2002	June 25-Sept 10	35,307	645,141	621	7,391
	Average 1995-2001	52,117	547,208	142	5,842

Appendix Table A.3. Historical salmon escapements at the Nome River counting tower, 1993-1995, and weir 1996-2002.

Year	Operating period	Chum	Pink	Chinook	Coho
1993	July 25-Aug 28	1,566	13,034	63	4,349
1994	June 24-Aug 15	2,893	141,246	54	726
1995	June 22-Sept 6	5,092	13,890	5	1,650
1996	June 26-Jul 23	3,339	95,681 [1]	5	66
1997	June 27-Aug 27	5,131	8,035	22	321
1998	July 01-Aug 11	1,930	359,469	70	96
1999	July 02-Aug 25	1,048	2,033	3	417
2000	June 29-Aug 25	4,056	44,368	25	698
2001	July 8-Sept 11	2,859	3,138	7	2,418
2002	June 29-Sept 11	1,720	35,057	7	3,418
	Average 1993-2001	3,102	75,655	28	1,193

[1] In 1996 the majority of pink salmon escaped through the pickets and were not counted.